To: Ms Margaret Liveris,
Committee Clerk,
Standing Committee on Environment and Public Affairs,
Legislative Council, Parliament House,
GPO Box A11 Perth WA 6837.

TO WHOM IT MAY CONCERN,

Re: Terms of Reference for the Senate inquiry into unconventional gas fracking in WA.

Wherever this industry has operated, it has generated much controversy over its safety and health impacts. I have listed a number of independent scientific reports that clearly demonstrate we should have serious concerns about potentially very serious adverse affects from this industry.

In the light of this, I feel extremely concerned that the terms of reference for this inquiry are far too narrow. They need to be expanded to encapsulate the following key risk areas of this industry.

- **Groundwater contamination**

The issue of greatest concern here is that of well integrity. The protection of any overlying aquifers to the drill region is completely dependent on the well remaining intact for ever. Dr. Ingraffea, the Dwight C. Baum Professor of Engineering at Cornell and an expert in the area of unconventional gas production, has established, based on PA DEP data, that Marcellus Shale well casings have failed at a rate of 6.2% in Pennsylvania in 2010 and 2011, causing immediate fluid migration (lecture by Ingraffea at "Marcellus Exposed" symposium, March 17th, 2012 _ recorded here _ http://www.youtube.com/watch?v=mSWmXpEkEPg). He also showed that by15 years after fracking was completed, 40-50% of wells had failed.

Another recent paper reports that shale rock is not impemeable as previously assumed and that after fracking has occurred, polluted water can migrate into aquifers above within just a few decades.
"Potential Contaminant Pathways from Hydraulically Fractured Shale to Aquifers"
Tom Myers - Groundwater, Volume 50, Issue 6, pages 872-882, November/December 2012
http://onlinelibrary.wiley.com/doi/10.1111/j.1745-6584.2012.00933.x/abstract

Another established source for aquifer contamination is from waste water spills at frack sites.
"Analysis of BTEX groundwater concentration from surface spills associated with hydraulic fracturing operations"
Journal of the Air & Waste Management Association, 14 Jan 2013
Gross SA, Avens HJ , Banducci AM, Sahmel J, Panko JM, Tvermoes BE

Furthermore a risk analysis for Marcellus shale fracking shows the contamination potential of water aquifers is substantial even in best-case scenarios.
"Water pollution risk associated with natural gas extraction from the Marcellus Shale"
Risk Analysis: An International Journal
28 December 2011 (ePub; printed August 2012)
Rozell DJ, Reaven SJ.

Also given that all forms of oil and gas extraction release Naturally Occurring Radioactive Material, the terms of reference need to include how these very dangerous substances well be dealt with and disposed of.

- **Air Pollution**

The terms of reference also need to include the potential for air pollution that could be harmful to health as this paper shows.

"Estimation of regional air-quality damages from Marcellus Shale natural gas extraction in Pennsylvania" _ Aviva Litovitz et al 2013 Environ. Res. Lett. 8 014017 doi: 10.1088/1748-9326/8/1/014017

- **Impacts on Farming and Pastoral Land and Other Natural Environments**

For the reasons listed above, it is imperative that the terms of reference should include the examination of impacts on these regions in particular.

- **Climate Change Impacts from Fugitive Emissions**

Prof Ingraffea has established that the effect of methane from Shale gas on Climate Change is at least as bad as from other fossil fuels.
"Venting and leaking of methane from shale gas development: response to Cathles et al."

Robert W. Howarth, Renee Santoro, Anthony Ingraffea in Climatic Change :July 2012, Volume 113, Issue 2, pp 537-549,

Another study that shows that nis atural gas not at all helpful for tackling climate change is _ "Greenhouse gases, climate change and the transition from coal to low-carbon electricity"

N P Myhrvold and K Caldeira 2012 Environ. Res. Lett. 7 014019 doi: 10.1088/1748-9326/7/1/014019

- **Cumulative Effects of Multiple Wells**

The effects of the whole gas field on the above impacts need to be examined.

- **Regulation**

Given that our current regulations do not require any consideration of impacts on water quality here in WA, from the sample of articles I have already listed, it is clear that our current regulatory system is inadequate to deal with this industry. This must be included in the terms of reference. Also given the seriousness of the findings shown in these articles, it is important that conflict of interests be avoided and independent regulatory bodies should administer control and oversight of this industry.

Given the seriousness of the potential for harm from the unconventional gas industry that independent science is now demonstrating, it is imperative that the Precautionary Principle should be adopted. It is important that adequate scientific data clearly demonstrating that none of these impacts will occur should be established before any approvals for this industry be granted. See the following discussion_

Madelon Finkel, Jake Hays, and Adam Law. "The Shale Gas Boom and the Need for Rational Policy". American Journal of Public Health: July 2013, Vol. 103, No. 7, pp. 1161-1163. doi: 10.2105/AJPH.2013.301285

Submitted by Judith A. Cullity